

MANITOWOC SHIPBUILDING, INC.

A SUBSIDIARY OF THE MANITOWOC COMPANY, INC.
DRYDOCKING • SHIPBUILDING • HEAVY MACHINERY • DESIGN AND REPAIR
500 SO. 16TH STREET - P. O. BOX 426 - PHONE 684-6621 - AREA CODE 414

MANITOWOC, WISCONSIN

April 23, 1965

N65-24988

FACILITY FORM 502

(ACCESSION NUMBER)

(PAGES)

(NASA CR OR TMX OR AD NUMBER)

(THRU)

(CODE)

(CATEGORY)

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Purchasing Office
Clinton Building
2109 Clinton Avenue
Huntsville, Alabama 35812

GPO PRICE \$ _____

OTS PRICE(S) \$ _____

Attention: PR-RCWeems

Subject: Contract NAS8-11577
M.S.I. Contract 4896
Final Report
Article 1, Paragraph D,
Subtitle 3

Hard copy (HC) 1.00

Microfiche (MF) .50

Gentlemen:

This letter is submitted to meet the final report requirements of the above contract as noted in Article 1, Paragraph D, Subtitle 3 and any other final requirements of this contract.

This contract was in essence a fabrication built to NASA's design and control requirements. The contract consisted of two weldments for an upper and lower spider as noted in your Drawing No. 90M-01295, Revision A, Sheets 1 through 7 and Drawing No. 90M-01296, Revision A, Sheets 1 through 9. The following reports were submitted in Manitowoc's letter dated October 9, 1964, Reference PR-RC, to Mr. R. T. Minard to meet the report requirements of Article 6, Paragraph C:

- (A) Inspection Diagram Drawing No. 4108
- (B) Chemical and Physical Report
- (C) Dimension Inspection Certification
- (D) Radiographic Inspection Certification

Therefore, since Article 6 specifically stated certification of chemical and mechanical properties of this material used in fabrication, we see no need in duplicating these reports at this time.

April 23, 1965

The following are for design and fabrication to consider for a new spider assembly:

- A. All friction joint surfaces of T₁ steel should be machined to insure flatness.
- B. Do not machine subassembly prior to complete assembly of weldments.
- C. Weld joint design and Procedures 1 through 15 inclusive are enclosed. These were developed for the above weldments by NASA and Manitowoc.
- D. All root and next to last weld passes to be magnafluxed as a method of weld quality control.
- E. All material should be laid out full scale prior to burning. This is recommended when material delivery presents a problem.
- F. Use lamp fixtures instead of strip elements to perform pre-heat required for welding T₁ steel.

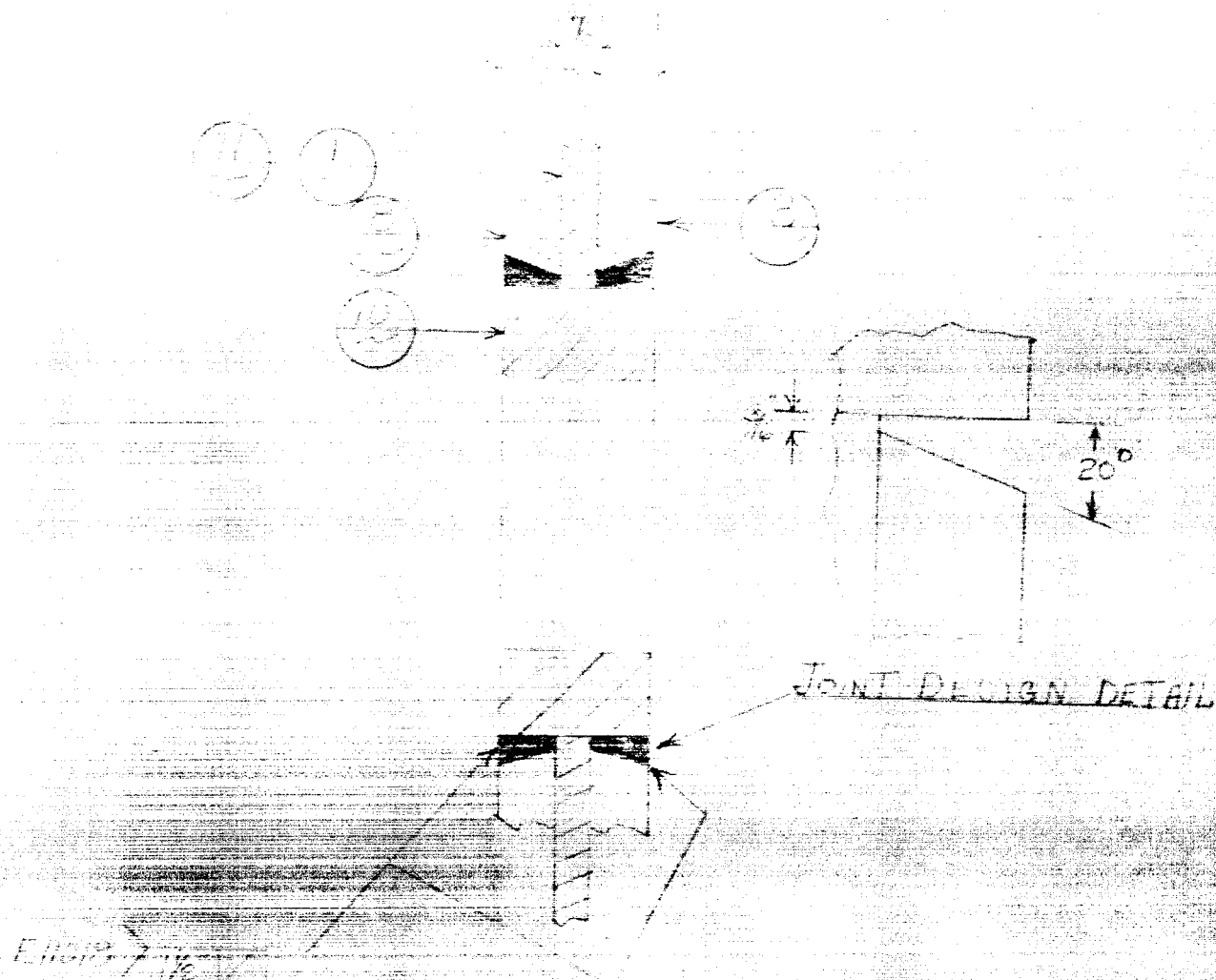
All the above information was transferred to Dave Johnson of NASA as the job progressed. Therefore, your drawings on this contract are current. Please advise by return mail should any additional information be needed to meet the contract requirements of the final report.

Very truly yours,

MANITOWOC SHIPBUILDING, INC.


R. E. O'Brien
Sales Engineer

REO/nn
Enc.



Welding Procedure:

Joint Type - Bevel 3/16" Root opening included angle - 20°
 Base Metal - T-1 Steel
 Filler Metal - 1/8", 5/32" & 3/16" Dia. E11018
 Position of Welding - Flat
 Welding Machine Settings -
 1/8" Dia. Electrode 90-160 Amp. 21-24 Volts D.C. Reverse Polarity
 5/32" " " 110-210 " 22-25 " " " "
 3/16" " " 160-300 " 23-26 " " " "
 Welding Process - Manual Shielded Metal Arc Welding
 Preheat - 150° - 275° F.

Revised Preheat Range & Amp. Range 3-18-64, B.M.



Welding Procedure:

Joint Type - Single-J 1/16" land 1/16" flat plus 1/4" Radius
 included Angle 30°

- Plug 1-15/16" Diameter

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11018

Position of welding - Bevel - Horizontal, Plug - Flat

Fillet - Flat or Horizontal

Welding Machine Settings

1/8" Dia. Electrode	93-160	Ampl.	12-24	Volts	D.C.	Reverse Polarity
5/32" "	"	"	113-210	"	"	"
3/16" "	"	"	160-300	"	"	"
7/32" "	"	"	190-330	"	"	"

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F.

Revised Amp. Range

2-18-64

B.M.

Include X-Ray on Mark

& to Mark

as per telephone conversation with D.I.J.

2-14-64

B.M.

1/8" \hat{A}
OK. H.T.G. 4/4/68

1/8" \hat{A}
OK. H.T.G. 4/4/68

Welding Procedure:

Joint Type - Double U 1/16" land 1/16" flat plus 1/4" radius
Included Angle - 60°
Double V 1/8" land included Angle - 60°
Double J 1/16" land 1/16" flat plus 1/4" radius
Included Angle - 90°

Base Metal - Items 14 & 15 - ASTM A36 Steel
- Items 34, 35 & 42 - T-1 steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E7018 & E6018

Position of Welding - Flat and Horizontal

Welding Machine Settings -

Electrode	Amp.	Volts	Polarity
1/8" Dia.	90-160	21-24	D.C. Reverse
5/32"	110-210	22-25	" " "
3/16"	150-300	23-26	" " "
7/32"	190-330	23-26	" " "

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F.

Revised Amp. Range

2-18-64

T.M.

Upper Spider

DRWG. #90M01295

Sheet 5

Sub-Assembly

Joint No. Assigned - 4

35°

fillet weld or
back up strips
100% Post Regd
OK. L.L.G. 4/6/64
1/16" Post Regd. E11018
1/16" Post Regd. E11018

Welding Procedure:

Joint Type - Single J 1/16" land 1/8" flat plus 1/4" Radius
Included Angle - 35°

Base Metal - T-1 Steel

Filler Metal - 1/8", 1/32" & 1/16" E11018

Position of Welding - Horizontal

Welding Machine Settings -

Electrode	Volts	Reverse Polarity
1/8" Dia. electrode	90-160 amp.	11-21 Volts D.C. Reverse Polarity
1/32" "	110-210 "	" " " " "
1/16" "	160-300 "	" " " " "

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 300° - 450° F.

Revised App. Range

3-18-64

B.M.

Revised Joint Design & Preheat Range

3-20-64

B.M.

F
2

Back up strip or
 fillet weld & modify
 groove as req'd for
 100% pent.

Welding Procedure:

Joint Type - Single J 1/8" land 1/8" Flat plus 1/4" Radius
 Included Angle - 30°
 - Double J 1/4" land 1/16" flat plus 1/4" Radius
 Included Angle - 30°

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11013

Position of Welding - Bevels and Fillets - Flat

Welding Machine Settings:

1/8" Dia. Electrode	20-160	Amp.	21-24	Volts	D.C.	Reverse	Polarity
5/32" "	"	"	110-210	"	21-25	"	"
3/16" "	"	"	160-300	"	23-26	"	"
7/32" "	"	"	190-330	"	23-26	"	"

Welding Process - Manual Shielded Metal Arc Welding

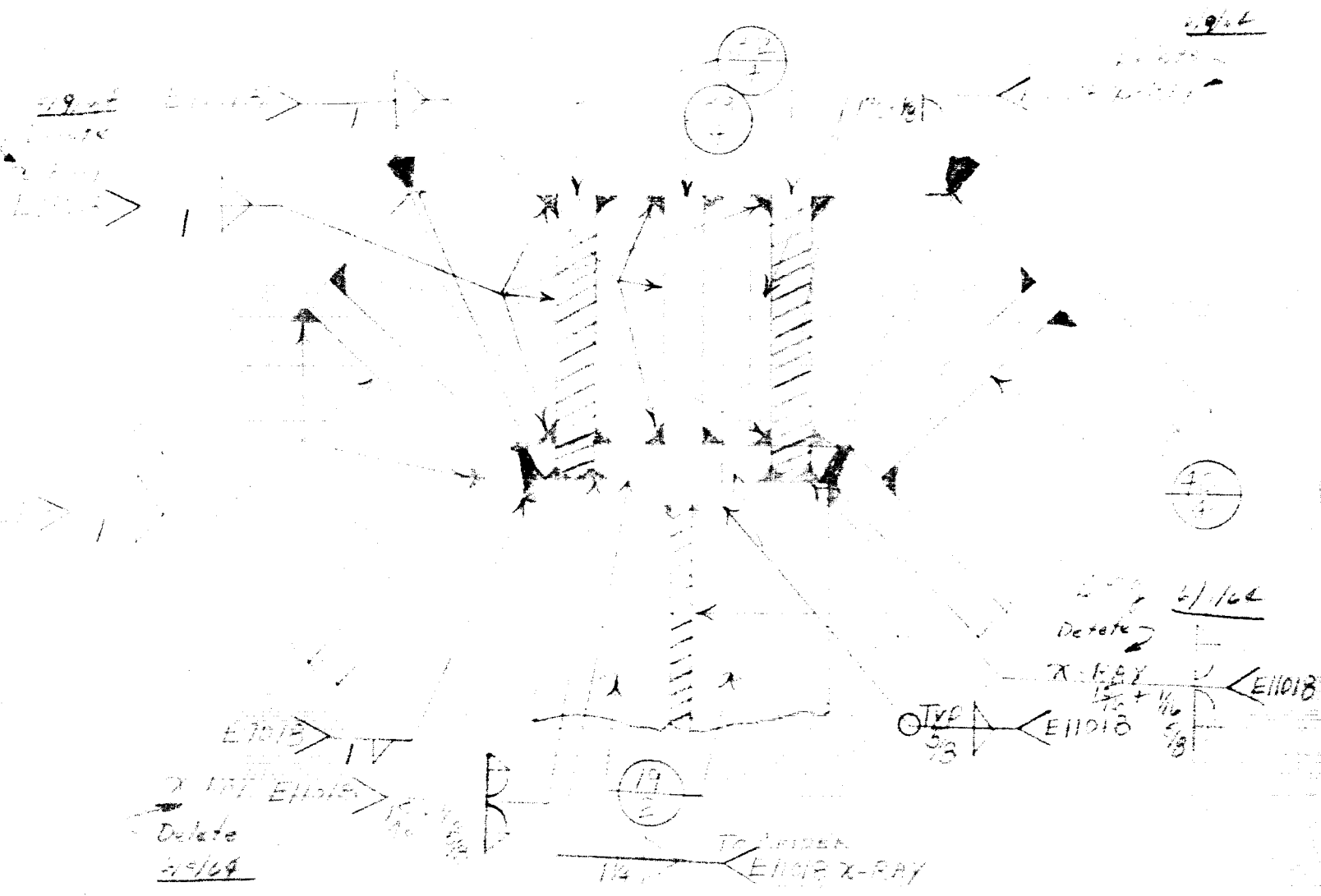
Preheater - ~~200° XXXX 100° XX~~ 300° - 450° F.

Revised Amp. Range
 Revised Preheat Range

3-18-64
 3-20-64

B.M.
 B.M.

OK.
 H.T.G.
 4/6/64



Welding Procedure:

- Joint Type - Double J 1/8" land 1/16" flat plus 1/4" Radius
- Included Angle - 30°
- Single J 1/8" land 1/16" flat plus 1/4" Radius
- Included Angle - 30°
- Fillets

Base Metal - Items 32, 33, 40 & 19 T-1 Steel

Fillet Metal - 1/8", 5/32", 3/16" & 7/32" E7018 & E11018

Position of Welding - Horizontal & Vertical

Welding Machine Settings:

1/8" Dia. Electrode	90-160	Amp.	21-24	Volts	D.C.	Reverse	Polarity
5/32" " "	110-210	"	22-25	"	"	"	"
3/16" " "	160-300	"	23-26	"	"	"	"
7/32" " "	190-330	"	23-26	"	"	"	"

Vertical

1/8" Dia. Electrode	190-150	Amp.	21-24	Volts	D.C.	Reverse	Polarity
5/32" " "	110-200	"	22-25	"	"	"	"

Welding Process - Manual Shielded Metal Arc Welding

Preheat - ~~1500XX~~ ~~2500XX~~ 2000° - 3500° F Delete X-Ray As Noted 6-9-64 B.M.

Revised Amp. Range

3-18-64

B.M.

Revised Preheat Range

3-20-64

B.M.

4-11-11 11:11 AM 11/11/11

4-11-11 11:11 AM 11/11/11

Delete X
Ray this
H also
4/19/11
D.E.S.

90% to 100%
Rent O.K. this
joint. Use back
up strip if
possible. O.K.
H.T.G. 4/19/11

Upper Spider Draw. 4/19/11
Sheet 6 Detail 4
Joint No. Assigned - 7

4/19/11

10

D.M.

Joint No. Assigned - 8

Detail

2

Upper Spider DWG. #90W01295 Sheet 6 Detail
Joint No. Assigned - 8
(See Sketch on Separate Sheet)

P
Z

Welding Procedure:

Joint Type - Double J - 1/16" land 1/16" flat plus 1/4" Radius
Included Angle - 30°
- Bevel - Included Angle 45°
- Fillets

Base Metal - ASTM A36

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E7018

Position of Welding - Horizontal & Vertical

Welding Machine Settings -

1/8" Dia. Electrode	90-160 Amp.	21-24 Volts	D.C.	Reverse Polarity
5/32" "	"	110-210 "	22-25 "	" " " "
3/16" "	"	160-300 "	23-26 "	" " " "
7/32" "	"	190-330 "	23-26 "	" " " "

Vertical

1/8" Dia. Electrode	90-150 Amp.	21-24 Volts	D.C.	Reverse Polarity
5/32" "	"	110-200 "	22-25 "	" " " "

Welding Process - Manual Shielded Metal Arc Welding

Preheat - ~~XXXX~~ 200° - 300° F. T-1 Plate Only

Revised Amp. Range

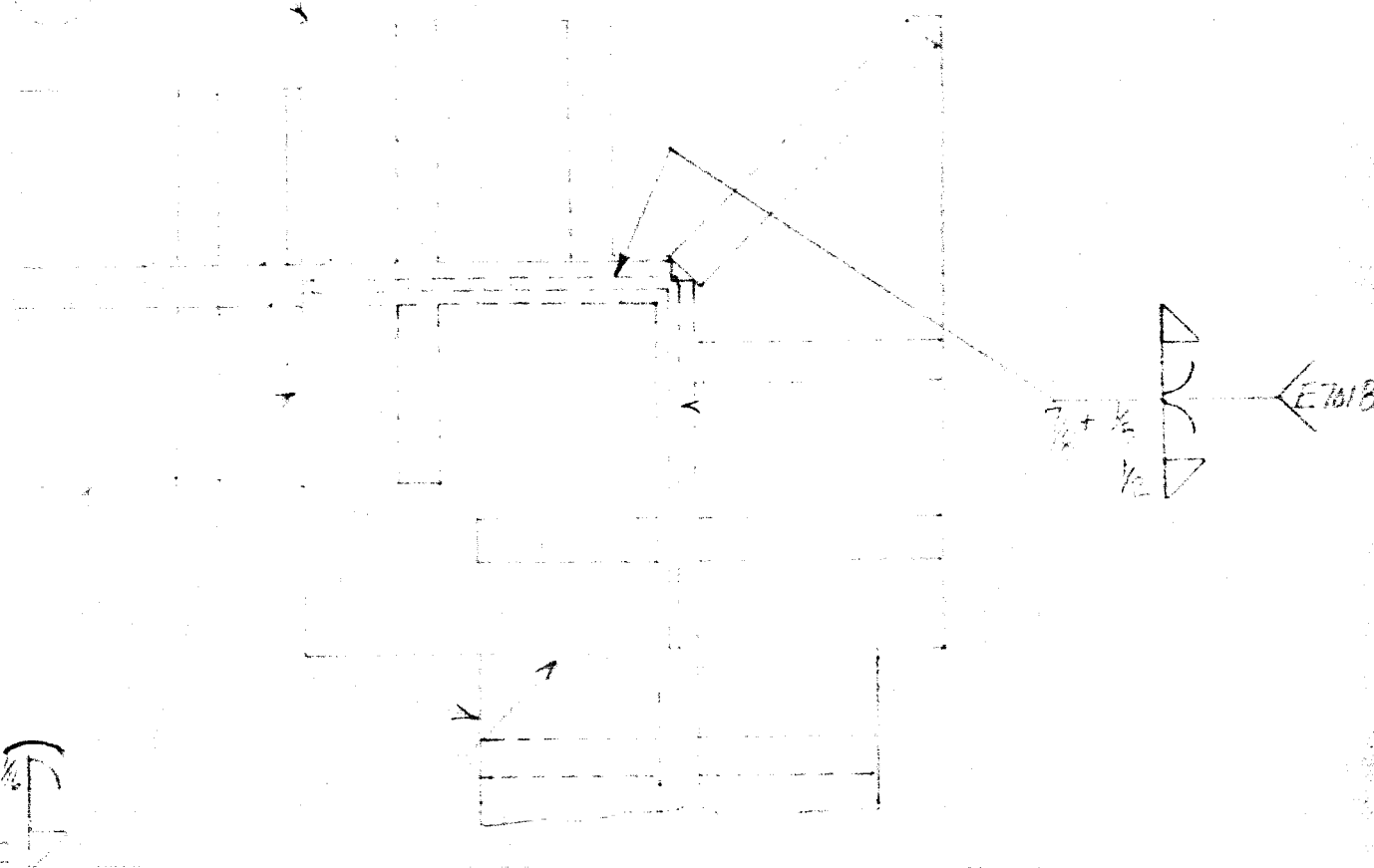
3-18-64

B.M.

Revised Preheat Range

3-20-64

B.M.



Welding Procedure:

- Joint Type - Single J - 1/16" land 1/16" flat plus 1/4" Radius
Included Angle - 30°
- Double J - 1/16" land 1/16" flat plus 1/4" Radius
Included Angle - 30°
Base Metal - Item $\frac{12}{4}$ ASTM A36
- Item $\frac{22}{5}$ T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E7018

Position of Welding - Flat or Horizontal

Welding Machine Settings:

1/8" Dia. Electrode	90-160	Amp.	21-24	Volts	D.C.	Reverse	Polarity
5/32" "	"	"	22-25	"	"	"	"
3/16" "	"	"	23-26	"	"	"	"
7/32" "	"	"	23-26	"	"	"	"

Welding Process - Manual Shielded Metal Arc Welding

Preheat - ~~250-350~~ 350° - 450° F.

Revised Amp. Range

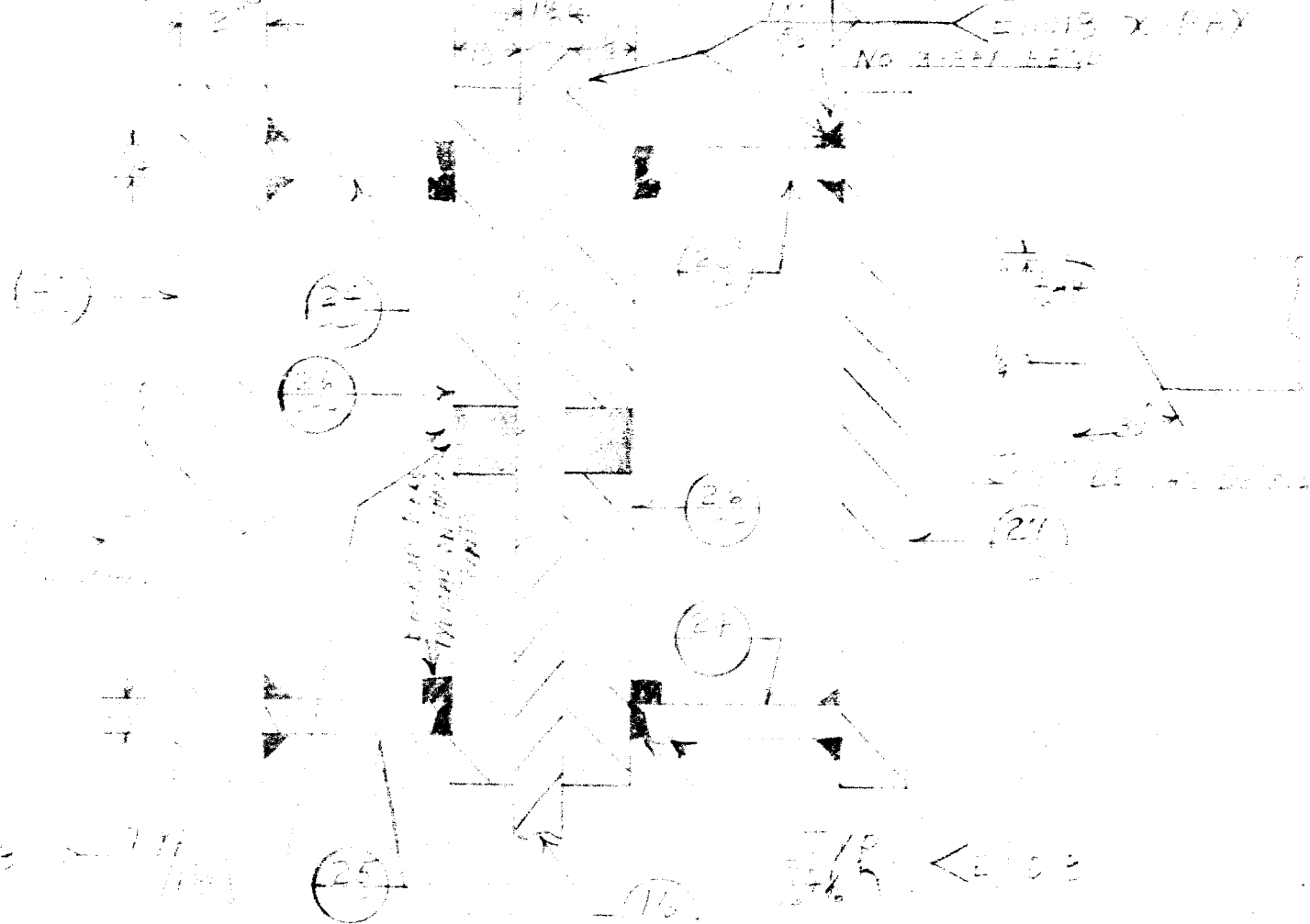
3-18-64

B.M.

Revised Preheat Range

3-20-64

B.M.



Welding Procedure:

Joint Types - Single J 1/16" land 1/16" flat plus 3/4" radius

Included Angle - 30°

- Plug 1-13/16" Diameter Hole

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11018

Position of Welding - Bevel - Horizontal, Plug - Flat, Fillets - Flat
or Horizontal

Welding Machine Settings -

Electrode	Amp.	Volts	D.C.	Reverse Polarity
1/8" Diameter Electrode	90-160	21-24	Volts	D.C. Reverse Polarity
5/32"	110-210	22-25	"	"
3/16"	160-300	23-26	"	"
7/32"	190-330	23-26	"	"

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F. for 1-1/2" Plate

200° - 300° F. for 2" Plate

Revised Amp. Range

3-18-64

B.M.

Revised Preheat Range

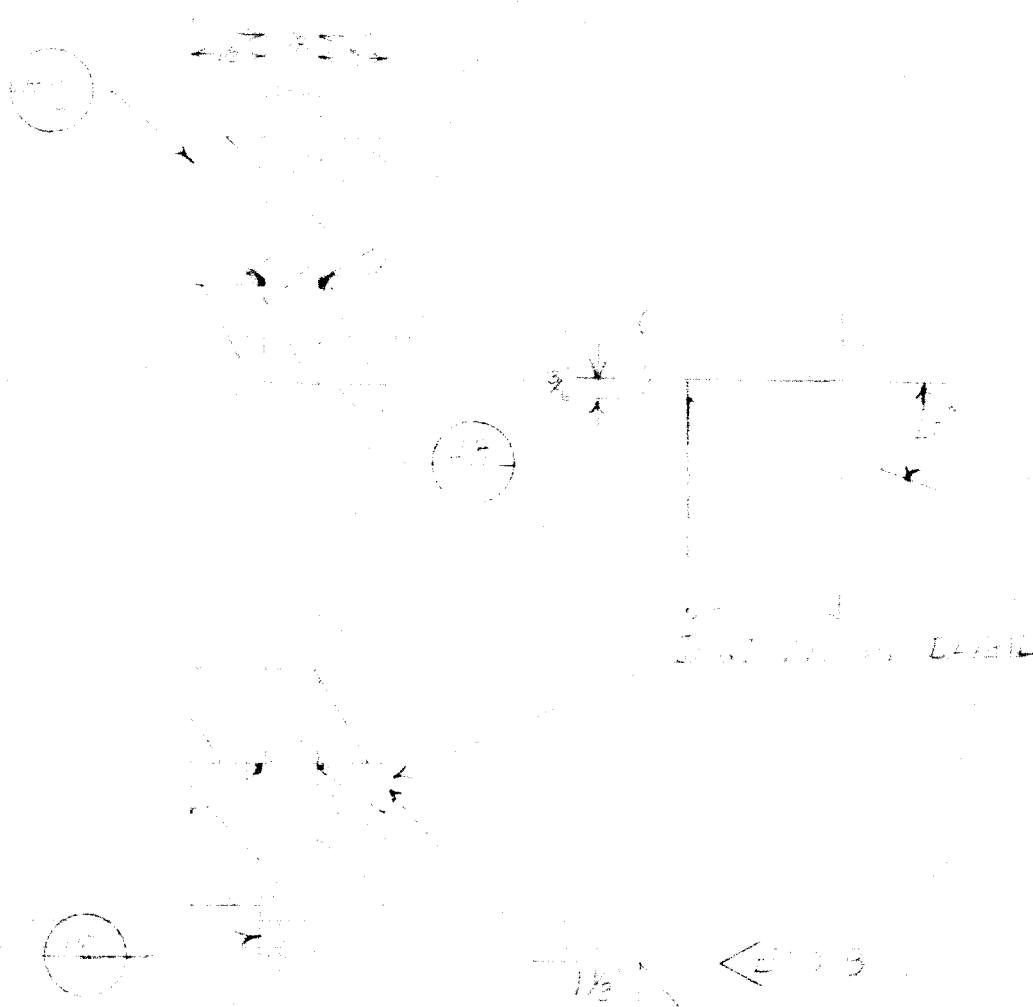
3-20-64

B.M.

Delete X-Ray of Items 24 & 25 to Items 26-27-16 per Telephone Conv.
with D.I.J.

4-27-64

B.M.



Welding Procedure:

Joint Type - Bevel 3/16" root opening included angle - 20°

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", & 3/16" Dia. E11018

Position of Welding - Flat

Welding Machine Settings -

1/8" Dia. Electrode 90-160 Amp. 21-24 Volts D.C. Reverse Polarity

5/32" " " 110-210 " 22-25 " " " " "

3/16" " " 160-300 " 23-26 " " " " "

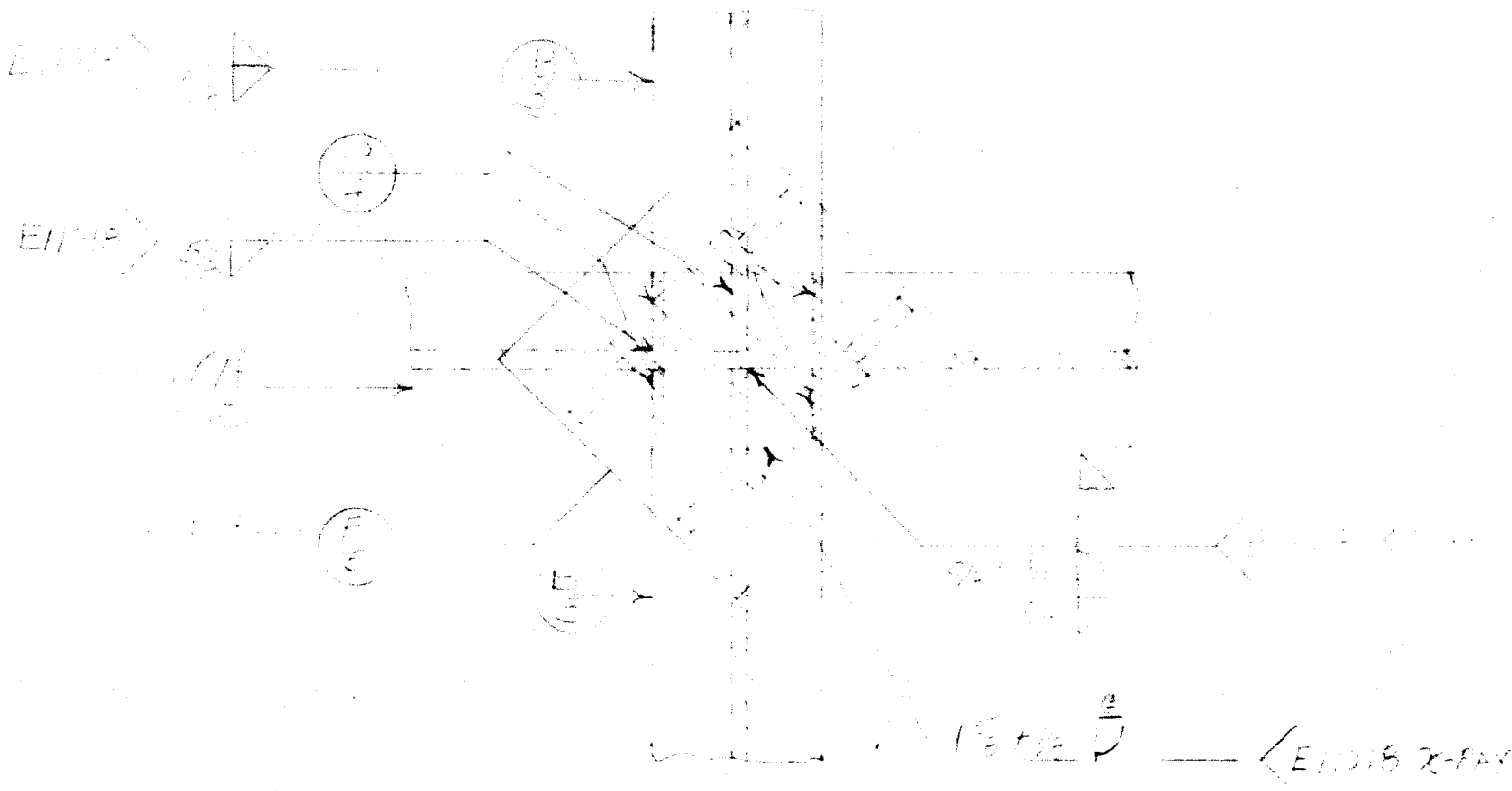
Welding Process - Manual Shielded Metal Arc Welding

Preheat - ~~1500-1500~~ 200° - 275° F.

Revised Preheat Range & Amp. Range

3-18-64

B.M.



Welding Procedure:

Joint Type - Double J 1/8" land 1/4" Radius included Angle - 30°
 - Single J 1/8" land 1/4" Radius included Angle - 30°
 - Fillet

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11018

Position of Welding - Flat, Horizontal, Vertical

Welding Machine Settings -

1/8" Dia. Electrode	90-160 Amp.	21-24 Volts	D.C.	Reverse	Polarity
5/32" "	"	110-210 "	22-25 "	" "	" "
3/16" "	"	160-300 "	23-26 "	" "	" "
7/32" "	"	190-330 "	23-26 "	" "	" "

Vertical

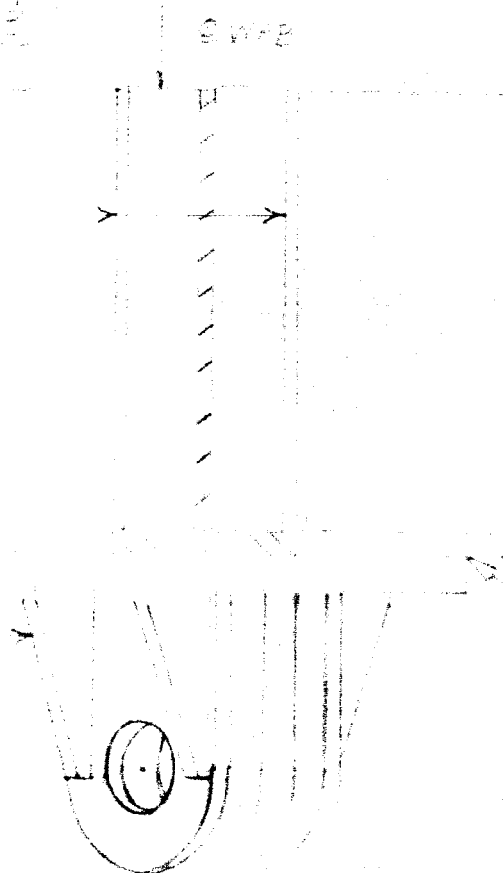
1/8" Dia. Electrode	90-150 Amp.	21-24 Volts	D.C.	Reverse	Polarity
5/32" "	"	110-200 "	22-25 "	" "	" "

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F.



(B)
4



1/8" Dia. Electrode
1/8" Dia.

(F)
5

1/8" V

← E11018 X-RAY

Welding Procedure:

Joint Type - Fillet

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11018

Position of Welding - Horizontal

Welding Machine Settings -

1/8" Dia. Electrode	190-160	Amp.	21-24	Volts D.C.	Reverse	Polarity
5/32" "	"	110-210	"	22-25	"	"
3/16" "	"	160-300	"	23-26	"	"
7/32" "	"	190-330	"	23-26	"	"

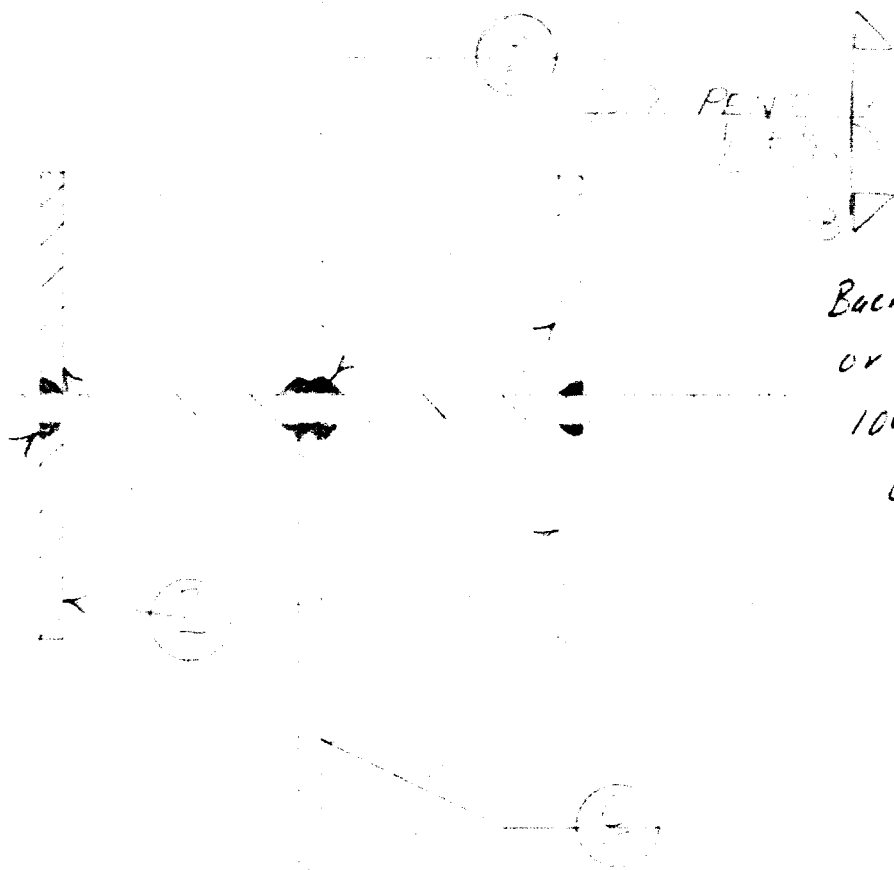
Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F.

Revised Amp. Range

3-16-64

B.M.



Welding Procedure:

Joint Type - Double J 1/8" land 1/16" Flat plus 1/4" Radius included
Angle - 30°
- Single J 1/8" land 1/16" Flat plus 1/4" Radius included
Angle 30°
Base Metal - T-1 Steel
Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11018
Position of Welding - Flat
Welding Machine Settings
1/8" Dia. Electrode 90-160 Amp. 21-24 Volts D.C. Reverse Polarity
5/32" " " 110-210 " 22-25 " " " " "
3/16" " " 160-300 " 23-26 " " " " "
7/32" " " 190-330 " 23-26 " " " " "
Welding Process - Manual Shielded Metal Arc Welding
Preheat - 150° - 250° F.

Revised Amp. Range

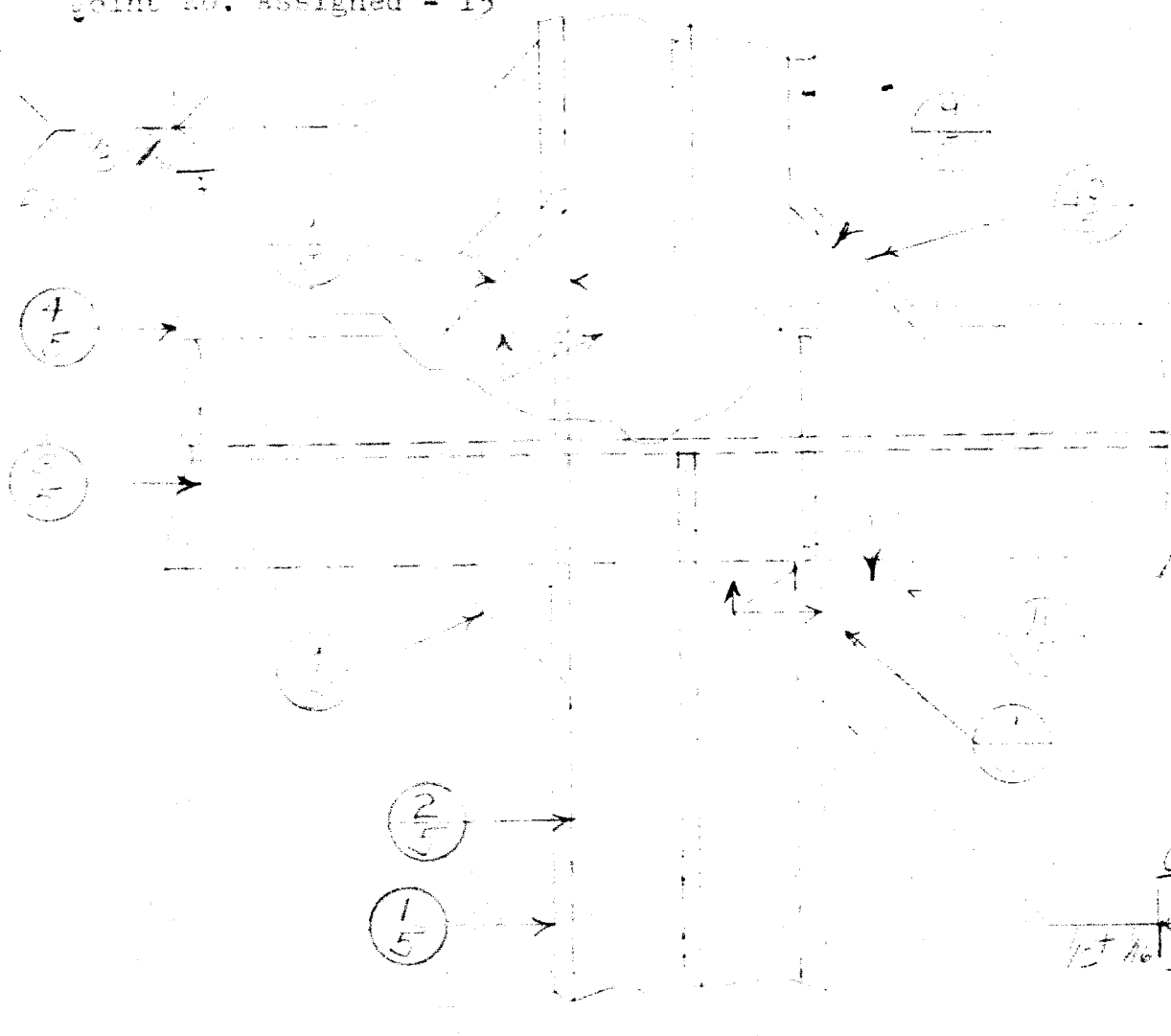
3-12-64

B.N.

Spider. DWG. #90M01296.
Joint No. Assigned - 15

Sub Assy.

7
Z



Welding Procedure:

Joint Type - Double Bevel 1/16" land included Angle - 45°

Base Metal - T-1 Steel

Filler Metal - 1/8", 5/32", 3/16" & 7/32" E11015

Position of Welding - Flat

Welding Machine Settings -

1/8" Dia. Electrode 90-160 Amp. 21-24 Volts D.C. Reverse Polarity

5/32" " " 110-210 " 22-25 " " " " "

3/16" " " 160-300 " 23-26 " " " " "

7/32" " " 190-330 " 23-26 " " " " "

Welding Process - Manual Shielded Metal Arc Welding

Preheat - 150° - 250° F.

Revised Amp. Range

3-18-64

B.M.